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Washington

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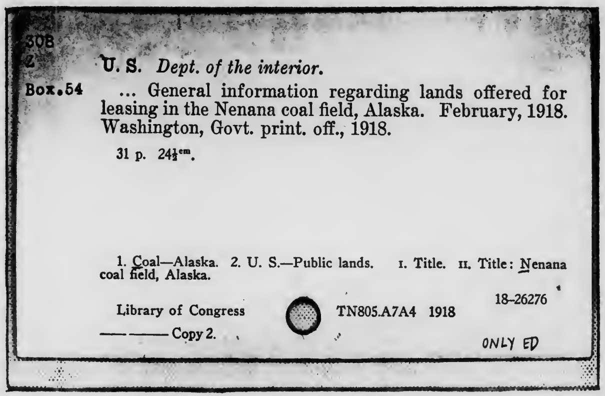

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DEPARTMENT OF THE INTERIOR

GENERAL INFORMATION

REGARDING

LANDS OFFERED FOR LEASING IN THE NENANA COAL FIELD, ALASKA

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FEBRUARY, 1918

WASHINGTON
GOVERNMENT PRINTING OFFICE
1918

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WASHINGTON
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May 11 1918

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GENERAL INFORMATION REGARDING LANDS OFFERED FOR LEASING IN NENANA COAL FIELD, ALASKA.

LEASING OFFER.

Department of the Interior,
Washington, February 13, 1918.

In pursuance of the authority vested in the Secretary of the Interior by the act of Congress approved October 20, 1914 (38 Stat., 741), "to provide for the leasing of coal lands in the Territory of Alaska," the following described coal lands in the Nenana coal field, Alaska, are now and hereby offered for leasing under the terms of said act and the regulations adopted and approved in accordance therewith, to wit:

LANDS OFFERED FOR LEASING IN NENANA COAL FIELD, FAIRBANKS BASE AND MERIDIAN.

Block No. 1.—Contains sec. 30 (except the NE. ¼ and NE. ¼ NW. ¼) and all of sec. 31, T. 11 S., R. 7 W. (area, 1.054.16 acres), and also an unsurveyed lot described as follows: Beginning at the northwest corner of sec. 30, T. 11 S., R. 7 W., thence due west to the right of way of the main line of the Government railroad, thence southerly along said right of way to the west line extended of sec. 31, T. 11 S., R. 7 W., thence north along the west line of secs. 31 and 30, T. 11 S., R. 7 W. to the place of beginning, containing 890 acres, more or less. Total area of Block No. 1 about 1,944 acres.

Block No. 4.—Contains the S. ½ and S. ½ NE. ¼ sec. 28, T. 11 S., R. 7 W.; all of sec. 33, T. 11 S., R. 7 W.; and the N. ½ NW. ¼ sec. 4. T. 12 S., R. 7 W. Area, 1,120 acres.

Block No. 5.—Contains the S. ½ SE. ¼ and SE. ¼ SW. ¼ sec. 22; all (except the NW. ¼ NW. ¼) of sec. 27; and all of sec. 34, T. 11 S., R. 7 W. Area, 1,360 acres.

Block No. 6.—Contains the SW. ¼ SW. ¼ sec. 2; the S. ½ SE. ¼ and W. ½ sec. 3; and the E. ½ sec. 4, T. 12 S., R. 7 W. Area, 760 acres.

Block No. 7.—Contains the S. ½ sec. 23; all of sec. 26; and the N. ½ NE. ¼, NW. ¼, and NW. ¼ SW. ¼ sec. 35, T. 11 S., R. 7 W. Area, 1,240 acres.

Block No. 8.—Contains the S. ½ NE. ¼ and N. ½ SE. ¼ sec. 35, T. 11 S., R. 7 W. Area, 160 acres.

Block No. 9.—Contains the SE. ¼ and S. ½ SW. ¼ sec. 24, all of sec. 25, and the N. ½ NE. ¼ and N. ½ NW. ¼ sec. 36, T. 11 S., R. 7 W. Area, 1,040 acres.

Block No. 10.—Contains all (except the W. ½ NW. ¼) of sec. 19 and all of sec. 30, T. 11 S., R. 6 W. Area, 1,177.55 acres.

Block No. 11.—Contains the N. ½ and NE. ¼ SW. ¼ sec. 31, T. 11 S., R. 6 W., and the SE. ¼ NE. ¼ sec. 36, T. 11 S., R. 7 W. Area, 393.33 acres.

Block No. 12.—Contains all of sec. 20 and all of sec. 29, T. 11 S., R. 6 W. Area, 1,280 acres.

Block No. 13.—Contains all (except the SW. ¼ SW. ¼) of sec. 32, T. 11 S., R. 6 W. Area, 600 acres.

Block No. 14.—Contains all of sec. 21 and all of sec. 28, T. 11 S., R. 6 W. Area, 1,280 acres.

Block No. 15.—Contains all (except the E. ½ NE. ¼) of sec. 33, T. 11 S., R. 6 W. Area, 560 acres.

Block No. 16.—Contains all of sec. 22 and all (except the SE. ¼ and SE. ¼ SW. ¼) of sec. 27, T. 11 S., R. 6 W. Area, 1,080 acres.

Block No. 17.—Contains the SE. ¼ and SE. ¼ SW. ¼ sec. 27, the E. ½ NE. ¼ sec. 33, and the NW. ¼ and NW. ¼ NE. ¼ sec. 34, T. 11 S., R. 6 W. Area, 480 acres.

Block No. 18.—Contains the S. ½ NE. ¼ and S. ½ sec. 34, T. 11 S., R. 6 W. Area, 400 acres.

Block No. 19.—Contains all of sec. 23 and the N. ½ NW ¼ sec. 26, T. 11 S., R. 6 W. Area, 720 acres.

Block No. 20.—Contains all (except the N. ½ NW. ¼) of sec. 26, T. 11 S., R. 6 W. Area, 560 acres.

Block No. 21.—Contains the NE. ¼ NE. ¼ sec. 34 and all of sec. 35, T. 11 S., R. 6 W. Area, 680 acres.

Block No. 22.—Contains the W. ½ W. ½ NE. ¼, and W. ½ SE. ¼ sec. 24, and the NW. ¼ and NW. ¼ SW. ¼ sec. 25, T. 11 S., R. 6 W. Area. 680 acres.

Block No. 23.—Contains the E. ½ SE. ¼ sec. 24, T. 11 S., R. 6 W.; the N. ½ NE. ¼ sec. 25. T. 11 S., R. 6 W.; the SW. ¼ sec. 19, T. 11 S., R. 5 W.: and the N. ½ NW. ¼ sec. 30, T. 11 S., R. 5 W. Area, 388.32 acres.

Block No. 24.—Contains the S. ½ NE. ¼, SE. ¼, E. ½ SW. ¼. and SW. ¼ SW. ¼ sec. 25, T. 11 S., R. 6 W. and the S. ½ NW. ¼ and SW. ¼ sec. 30, T. 11 S., R. 5 W. Area, 589.08 acres.

Block No. 25.—Contains the N. ½, N. ½ SE. ¼, and N. ½ SW. ¼ sec. 36, T. 11 S. R 6 W. and the NW. ¼, N. ½ SW. ¼, NW. ¼ SE. ¼, and SW. ¼ NE. ¼ sec. 31. T. 11 S.,R. 5 W. Area. 790.05 acres.

Franklin K. Lane,
Secretary.

COAL LANDS RESERVED.

The President has designated and reserved from use, location, sale, lease, or disposition, under section 2 of the leasing act, the following lands, comprising leasing blocks Nos. 2 and 3:

T. 11 S., R. 7 W., SE. ¼ SE. ¼ sec. 29,
All of sec. 32.
T 12 S., R. 7 W., S. ½ NW. ¼, SW. ¼ sec. 4,
All of sec. 5.

containing 1,560 acres.

GENERAL REGULATIONS.

The regulations governing coal-land leases in the Territory of Alaska, approved May 18, 1916 (45 L. D. 113), including the forms of application and lease, will govern proceedings hereunder so far as applicable, with the following modifications:

1. On request addressed to the Commissioner of the General Land Office at Washington, D. C., a blank application and lease will be furnished the applicant; also those who desire may procure from the superintendent of documents, Government Printing Office, Washington, D. C., a folio containing photolithographic copies of the approved plats of the topographic and subdivisional township surveys of the field for $1.

2. Applications for coal-mining leases of the lands will be received at the General Land Office from duly qualified applicants up to and including March 1, 1918; and publication of these applications will commence March 4, 1918, and continue for a period of 30 days, under paragraph 7 of the regulations, amended December 3, 1917, to read as follows:

> 7. When the time for filing such applications shall have expired all applications then on file will be promptly listed and the proposed terms thereunder will be noted. Thereafter due publication at the expense of the Government for not less than once a week for a period of 30 days will follow in at least two newspapers of general circulation, one of which shall be published in the Territory of Alaska and one in the United States proper, of the applications filed, each to be designated by a number and not by the name of the applicant, the block or blocks applied for, with the announcement that at the expiration of the period of publication the said applications will be taken up and the proposals therein considered, subject to any better terms that may be offered by any other qualified applicant during the period of publication, or by the first applicant.

THE NENANA COAL FIELD.

GENERAL FEATURES.

GEOGRAPHY.

The Nenana coal field lies in latitude 64° N., longitude 149° W., in the northern foothills of the Alaska Range, which form a belt about 20 miles wide between the high mountains and the lowlands of the Tanana Valley. This foothill area is rugged and includes a series of nearly parallel ridges and intervening areas of less relief. Most of the coal areas are in lowland tracts that lie between the foothill ridges and are drained by eastward or westward flowing tributaries of the major streams which head in the high mountains and flow northward across the foothill belt.

Nenana River, the largest stream in the area, heads south of the Alaska Range and flows northward to join the Tanana at Nenana. Its valley, which affords a line of communication between the valley of the Tanana and the southern coast, is followed by the Government railroad now under construction. Among the larger tributaries of Nenana River from the east and west are Hoseanna (or Lignite) Creek and Healy Creek, which drain two of the principal coal areas. The coal lands in the valley of Hoseanna Creek are of greatest present importance, as they have been wholly surveyed and are easily accessible to the main line of the railroad. By the present railroad route the mouth of Hoseanna Creek is about 364 miles from the coastal terminus at Seward and about 106 miles from the inland terminus at Fairbanks.

The coal lands of the Nenana coal field, that have been offered for leasing are embraced in T. 11 S., Rs. 5, 6, and 7 W., and T. 12 S., R. 7 W., of the Fairbanks meridian, and are the more accessible and most immediately minable of the surveyed lands of the field, which lands include parts of T. 9 S., Rs. 5, 6, and 7 W., T. 10 S., R. 6 W.; T. 11 S., Rs. 5, 6, and 7 W.; and T. 12 S., R. 7 W.

CLIMATE AND VEGETATION.

The climate of the Nenana coal field is in general that of the more mountainous part of the Yukon basin. The short, hot summers contrast strongly with the long, cold winters. The precipitation in the coal field is very light compared with that on the coast but is probably considerably greater than that at Fairbanks. The summer rainfall consists largely of violent showers. The snowfall is light.

The timber is chiefly spruce, birch, and poplar which extend up to an altitude of about 2,500 feet. There are no dense forests or large areas of merchantable timber. Areas of timber suitable for use in mines must be carefully sought and guarded from fire, which has already done serious damage. The best growth of timber and of grass is on the gravels. The areas of coal-bearing rocks are poorly drained and support only moss, willows, and a very inferior and worthless growth of black spruce.

TRANSPORTATION.

The coal of the Nenana field can be brought to the present assured markets only over the Government railroad, now under construction. The approved route of this railroad passes through the western (unsurveyed) part of T. 12 S., R. 7 W. From the mouth of Hoseanna Creek, in sec. 6 (unsurveyed), a branch line can be built up the creek into the heart of the coal field. This branch will reach possible mining sites in blocks 2 and 3 within 2 miles of the junction. More favorable mining sites in blocks 7, 8, and 9 can be reached by a branch 6 miles long. A branch 12 miles long will reach as far east as block 20. This 12-mile branch will not involve heavy construction or steep grades and will afford access to as many mines as need be opened for many years. A 6-mile branch that will afford access to blocks 1 to 9 is probably all that will be necessary in the near future.

The coal on the headwaters of Hoseanna Creek can be reached only by spurs having heavy grades and expensive construction.

The coal on the tributaries of Totatlanika Creek, in T. 9 S., Rs. 5, 6, and 7 W.; T. 10 S., R. 6 W.; T. 11 S., R. 5 W.; and the north half of T. 11 S., R. 6 W. can be brought to the present markets only over a railroad along Totatlanika Creek to Tanana River. The abundance of coal on Nenana River and its tributaries makes it certain that no railroad will be built along Totatlanika Creek until it is needed for the shipment of other commodities than coal.

GEOLOGY.

The rocks of the Nenana coal field consist of the coal-bearing beds, metamorphic and igneous rocks beneath the coal-bearing beds, and gravels, sands, and silts above them.

The coal-bearing strata consist of slightly consolidated sands, clays, and gravels with numerous beds of lignite. These beds are of Tertiary age. Their thickness, as measured by the writer on Hoseanna Creek, is at least 1,200 feet. Their thickness on Healy Creek is stated by Prindle to be about 1,500 feet. The coal-bearing beds rest unconformably upon Paleozoic (?) schist and igneous rocks and are overlain unconformably by Quaternary gravels, 1,500 or 2,000 feet thick.

The structure of the coal areas is fairly simple. The individual coal areas consist of shallow and gently warped basins in which the beds are at some places steeply folded or faulted against masses of crystalline rock that separate the basins. The rock beds and the known faults strike in general about east. The dips are in general not steeper than 10° or 15°, though there are local zones in which the dip is steeper as well as broad areas in which the rocks lie nearly flat. No intrusive rocks are known to cut the coal measures.

COAL.

OCCURRENCE AND CHARACTER.

The coal of the Nenana field occurs in many beds of different thickness, the thickest measuring, perhaps, 30 or 35 feet, which are distributed rather uniformly through the coal measures. At least 12 coal beds are of workable thickness, and six or more measure over 20 feet. No geographic or stratigraphic variation in the character of the coal was noted. The analyses given below show that the coal is a lignite of good grade, of about the same quality as that of Cook Inlet.

Analyses of Nenana Coals.

As received.

[Samples collected by U. S. Geological Survey, analyses by Bureau of Mines except as indicated.]

Locality.	Exposure No.	Thickness (feet).	Laboratory No.	Proximate.				Ultimate.					Air-drying loss.	Calorific value.	
				Moisture.	Volatile matter.	Fixed carbon.	Ash.	Sulphur.	Hydrogen.	Carbon.	Nitrogen.	Oxygen.		Calories.	British thermal units.
T. 9 S., R. 6. W., sec. 15, SW. ¼ SW. ¼	18	10½	26359	38.22	23.84	22.15	15.79	0.36	6.45	31.14	0.49	45.77	32.1	2,924	5,263
T. 10 S., R. 6 W., sec. 27, SW. ¼ NE. ¼	27	12	26361	26.50	25.12	16.40	31.98	.19	5.35	27.40	.48	34.60	19.8	2,615	4,707
Do	27	6½	26360	25.66	32.28	22.80	19.26	.21	5.93	37.86	.53	36.21	18.1	3,599	6,478
T. 11 S., R. 6 W., sec. 26, SE. ¼ SE. ¼	77	10+	26365	23.24	37.59	34.93	4.24	.14	6.25	51.53	.57	37.27	10.7	4,935	8,883
T. 11 S., R. 6 W., sec. 26, NW. ¼ SE. ¼	78	16	26363	28.71	35.91	30.26	5.12	.16	6.67	45.81	.59	41.65	19.8	4,311	7,760
T. 11 S., R. 6. W., sec. 26, SW. ¼ SW. ¼	80	12	26364	22.15	35.39	29.68	12.78	.20	5.91	45.12	.59	35.40	12.2	4,272	7,690
T. 11 S., R. 6 W., sec. 27, SE. ¼ NW. ¼	89	25	26366	24.32	37.95	29.35	8.38	.19	6.33	46.84	.61	37.65	15.6	4,456	8,021
T. 11 S., R. 6 W., sec. 30, SE. ¼ SW. ¼	111	26	26362	20.62	38.80	30.02	10.56	.19	5.87	47.45	.66	35.27	10.4	4,480	8,064
T. 11 S., R. 7 W., sec. 35, NW. ¼ NW. ¼	161	32	26369	23.83	35.55	28.87	11.75	.41	5.58	42.67	.66	38.93	14.6	3,893	7,007
T. 12 S., R. 7 W., sec. 5, NE. ¼ NW. ¼	173	15	26367	25.30	36.08	32.64	5.98	.26	6.39	47.55	.59	39.23	16.1	4,520	8,136
Hoseanna Creek [a]			26588	32.51	33.62	27.17	6.70	.14	6.31	39.86	.60	46.39	23.5	3,687	6,637
Do			26589	27.92	35.82	29.23	7.03	.11	6.51	44.99	.50	40.86	18.7	4,437	7,987
Nenana River, west bank, 1½ miles below Hoseanna Creek [b]		5	23042	28.16	34.52	33.68	3.64	.15					19.2	4,487	8,077
Healy Creek 1 mile above mouth		12	26368	21.50	41.82	30.77	5.91	.25	6.05	49.17	.67	37.95	10.4	4,767	8,581
Healy Creek 6¼ miles from mouth [c]		18	17796	27.41	34.67	33.49	4.43	.16	6.71	48.51	.68	39.51	12.3	4,604	8,287
Igloo Creek, tributary to Healy Creek, 6 miles from mouth [c]			17794	25.73	36.39	34.52	3.36	.15	6.87	51.41	.71	37.50	12.7	4,853	8,735
Do			17795	28.52	34.29	33.59	3.60	.06	6.68	48.05	.68	40.93	14.2	4,494	8,089
Healy Creek [d]				13.02	48.81	32.40	5.77	.16							

[a] Collected by G. W. Evans.

[b] Collected by Thomas Riggs, jr.

[c] Collected by Joseph A. Holmes.

[d] Collected by L. M. Prindle; analysis by United States Geological Survey.

Analyses of Nenana Coals—Continued.

Air dried.

Locality and sample.				Proximate.				Ultimate.					Calorific value.	
Locality	Exposure No.	Thickness (feet).	Laboratory No.	Moisture.	Volatile matter.	Fixed carbon.	Ash.	Sulphur.	Hydrogen.	Carbon.	Nitrogen.	Oxygen.	Calories.	British thermal units.
T. 9 S., R. 6 W., sec. 15, SW. ¼ SW. ¼	18	10½	26359	9.05	35.10	32.60	23.25	0.53	4.26	45.84	0.72	25.40	4,305	7,749
T. 10 S., R. 6 W., sec. 27, SW. ¼ NE. ¼	27	12	26361	8.35	31.32	20.45	39.88	.24	3.93	34.17	.60	21.18	3,261	5,870
Do	27	6½	26360	9.28	39.39	27.83	23.50	.26	4.79	46.20	.65	24.60	4,392	7,906
T. 11 S., R. 6 W., sec. 26, SE. ¼ SE. ¼	77	10+	26365	14.08	42.07	39.10	4.75	.16	5.67	57.68	.64	31.10	5,524	9,943
T. 11 S., R. 6 W., sec. 26, NW. ¼ SE. ¼	78	16	26363	11.13	44.77	37.72	6.38	.20	5.57	57.11	.74	30.00	5,374	9,673
T. 11 S., R. 6 W., sec. 26, SW. ¼ SW. ¼	80	12	26364	11.35	40.30	33.80	14.55	.23	5.19	51.38	.67	27.98	4,865	8,757
T. 11 S., R. 6 W., sec. 27, SE. ¼ NW. ¼	89	25	26366	10.35	44.95	34.77	9.93	.23	5.45	55.48	.72	28.19	5,278	9,500
T. 11 S., R. 6 W., sec. 30, SE. ¼ SW. ¼	111	26	26362	11.45	43.28	33.49	11.78	.21	5.26	52.93	.74	29.08	4,998	8,996
T. 11 S., R. 7 W., sec. 35, NW. ¼ NW. ¼	161	32	26369	10.83	41.62	33.80	13.75	.48	4.64	49.95	.77	30.41	4,558	8,204
T. 12 S., R. 7 W., sec. 5, NE. ¼ NW. ¼	173	15	26367	10.93	43.02	38.92	7.13	.31	5.49	56.69	.70	29.68	5,389	9,700
Hoseanna Creek [a]	......	......	26588	11.83	43.92	35.50	8.75	.18	4.83	52.07	.78	33.39	4,816	8,669
Do	......	......	26589	11.33	44.07	35.95	8.65	.14	5.45	55.34	.62	29.80	5,458	9,824
Nenana River, west bank, 1½ miles below Lignite Creek [b]	......	5	23042	11.04	42.74	41.71	4.51	.19	......	......	......	......	5,556	10,001
Healy Creek 1 mile above mouth	......	12	26368	12.35	46.70	34.35	6.60	.28	5.46	54.90	.75	32.01	5,323	9,581

[a] Collected by G. W. Evans.

[b] Collected by Thomas Riggs, jr.

MINING CONDITIONS.

The coal in the Nenana field will probably at first be mined by drifts or slopes run from outcrops of coal on the sides of the valleys or by stripping. The abundance of easily accessible coal and the moderate size of the prospective markets make it certain that deep mining will not be necessary for many years.

The most favorable site for stripping is on the 20-foot bed in block 8, sec. 35, T. 11 S., R. 7 W., about 5 miles above the mouth of Hoseanna Creek. A moderate amount of coal may perhaps be cheaply mined by stripping in blocks 2 and 3, sec. 5, T. 12 S., R. 7 W., a little over a mile above the mouth of Hoseanna Creek, and perhaps at other localities.

The coal beds have been extensively burned in many parts of the field, especially in T. 9 S., R. 6 W., where only about half a dozen unburned outcrops were observed. The burning began prior to the deposition of the thick Pleistocene gravels and still continues. The depth of the burning is not known, but as burned outcrops are more numerous in the less dissected than in the deeply dissected areas the burning is probably surficial. The burning makes the value of large areas problematic and indicates the danger of fires in the mines.

Extensive slumping was noted on many hillsides. In some places acres of the surface beds have slid bodily for long distances. Most of the slides observed have been caused by the removal of moss by forest fires. This removal allows the ground to thaw and permits the surface waters to soften the clays that form a large part of the coal-bearing strata. Some slides have been caused by the burning of large coal beds that had supported the surface strata. The marked tendency to slump should be carefully considered not only in underground mining but in surface operations, such as the stripping of coal beds, grading, and the removal of forests and moss.

The coal will probably be used as locomotive fuel on the Government railroad, for generating power and for thawing at the mines in Tanana Valley, as domestic fuel in Tanana Valley, and as fuel on Tanana River boats and possibly on some of the Yukon steamers. Nenana coal, rather than the better and nearer Matanuska coal, should, if possible, be used on the greater part of the railroad, because the heavy freight traffic will be northbound and the southbound empties will be available for hauling coal. The Nenana coal field is nearer the summit of the Alaska Range than any known coal field south of the divide.

LOCAL FEATURES.

T. 11 S., R. 5 W.

COAL EXPOSURES.

Many coal beds are exposed in this township, but only those that lie within the leasing blocks will be described here.

Sec. 19.—The following outcrop was noted in sec. 19:

Exposure No. 7.[1] Section on northeast bank of Hoseanna Creek near the northeast corner of the NE. ¼ SW. ¼ sec. 19, T. 11 S., R. 5 W.

	Feet.
Sands with two or more thin coal beds	60±
Coal	6
Clay	20
Coal	12
Concealed	160
Coal	11

---

[1] Numbers correspond to those used on the map.

Sec. 30.—The beds noted in sec. 30 are described below.

Exposure No. **16**. A coal bed about 8 feet thick, exposed in a stream in the NW. ¼ NW. ¼ sec. 30, at an altitude of 2,650 feet, probably dips at a low angle to the eastward.

Exposure No. **17**. Section in bluff on north side of stream in the SW. ¼ NW. ¼ NW. ¼ sec. 30, T. 11 S., R. 5 W., at an altitude of 2,550 feet (base of exposure).

	Feet.
Coal	10(?)
Concealed and sands	75
Coal	20

Sec. 31.—No exposures of coal beds were seen in sec. 31, but there are coal smuts at several localities.

MINING CONDITIONS.

There undoubtedly is a large amount of coal in this township, much of which is above the general drainage level and can be mined without shafts from openings on the larger creeks.

TRANSPORTATION.

The coal in secs. 18, 19, 30, and 31 and in the western part of secs. 20 and 29 is in the drainage basin of Hoseanna Creek and will find its natural outlet over a branch railroad extending up that creek from Nenana River. There is, however, so large a quantity of easily accessible coal in the lower part of the valley of Hoseanna Creek that probably no such branch will be built into this township for many years.

The coal of the rest of the township is in the drainage basin of Totatlanika Creek, which is tributary to Tanana River, and will find its natural outlet over an independent railroad up the Totatlanika. Such a railroad will not be built for a great many years, unless other industries than coal mining require it.

It is probable that the placer mines of Totatlanika Creek and its tributaries will require a small amount of coal, some of which may be obtained in this township. A little coal has already been mined for this purpose in sec. 8.

STATUS OF COAL LAND.

The coal of this township is so remote from the present markets and from the proposed railroad that there will probably be no demand for leases, except possibly for a small mine, producing not more than several hundred tons annually to supply the local placer miners.

The coal lands of the larger part of this township have not been divided into leasing units, but will be held in their present status until there is a call for the granting of leases or of local mining permits.

The coal lands of the SW. ¼ sec. 19, of the W. ½ sec. 30, and of sec. 31 (except the N. ½ NE. ¼) are included in leasing blocks 23, 24, and 25. As the coal of these lands can be most economically mined in connection with the coal of T. 11 S., R. 6 W., these tracts are more fully discussed in the description of that township (p. 20).

T. 11 S., R. 6 W.

COAL EXPOSURES.

Sec. 7.—Exposure No. **50.** On a tributary of Marguerite Creek in the S. ½ SW. ¼ SE. ¼ sec. 7 is a coal bed 3 feet thick.

An unmeasured coal bed is exposed also in the NW. ¼ SW. ¼ SE. ¼ sec. 7.

Sec. 18.—Exposure No. **51**. On a tributary of Marguerite Creek in the NW. ¼ NW. ¼ NE. ¼ sec. 18 a coal bed 12 feet thick strikes N. 75° W. and dips 25° S.

Exposure No. **52**. On a tributary of Marguerite Creek on the north line of the NW. ¼ NW. ¼ NE. ¼ sec. 18 a 6-foot bed of coal is exposed.

Sec. 20.—The following exposures were noted in sec. 20:

Exposure No. **53.** Section on tributary of Hoseanna Creek in the E. ½ NE. ¼ sec. 20, T. 11 S., R. 6 W., at an altitude of 2,080 feet.

	Ft.	in.
Coal	4	
Sand and gravel	50	
Coal	4	
Clay		6
Coal	20	6

Strike N. 70° W., dip 45° S.

Smut, probably from the 4-foot bed of the above section, was seen at the stream junction at an altitude of 2,040 feet in the NE. ¼ SE. ¼ NE. ¼ sec. 20. A poorly exposed coal smut was seen also in the SE. ¼ SE. ¼ SE¼.

Sec. 22.—Several exposures were observed in sec. 22, as indicated below.

Exposure No. **54.**. Section on headwater forks of gulch tributary to Hoseanna Creek in the W. ½ SW. ¼ sec. 22, T. 11 S., R. 6 W., at an altitude of 2,390 feet.

	Feet.
Cross-bedded sands and gravels	50
Coal	1
Clays	2½
Coal	1
Sands and gravels	40
Coal	3½
Sands and gravels	80
Coal	5

Strike N. 78° W., dip 5° N.

A small bed of coal probably lies in the gulch in the SW. ¼ SE. ¼, at an altitude of 2,180 feet.

Exposure No. **55.** In a gulch tributary to Hoseanna Creek in the SW. ¼ SE. ¼, at an altitude of 2,280 feet, about 5 feet of coal crops out and is overlain by a 1-foot bed of poor coal..

Exposure No. **56.** On Marguerite Creek in the NE. ¼ NE. ¼, at an altitude of 2,520 feet, is a bed of coal about 6 feet thick, which strikes N. 60° E. and dips 30° S. Smut is present about 200 feet downstream from this exposure.

Smut, probably from a fairly large bed (6 feet ?), occurs on Marguerite Creek in the NE. ¼ NW. ¼, at an altitude of 1,900 feet. Smut was seen in the NE. ¼ NE. ¼ NW. ¼, and smut and burned clay in the NW. ¼ NE. ¼ NW. ¼.

Exposure No. **57.** At the bend of Marguerite Creek just east of the northwest corner of the NE. ¼ coal 3 feet thick crops out.

Sec. 23.—Exposure No. **58.** A 4-foot bed of coal occurs on Marguerite Creek in the SW. ¼ NW. ¼ NW. ¼ sec: 23.

Smut that is probably from a small bed is found on Marguerite Creek in the NE. ¼ NW. ¼, and burned clay, apparently from a rather large bed occurs near the center of the NW. ¼.

Sec. 24.—Exposure No. **59.** In the eastern part of the SE. ¼ NW. ¼ sec. 24 is a 4-foot bed of coal dipping 5°–8° S., overlain and underlain by sands.

Three lignite beds, 3 to 6 inches thick, are exposed in the SW. ¼ SW. ¼ NE. ¼ sec. 24.

Exposure No. **60.** In a gulch in the S. ½ SW. ¼ NE. ¼ sec. 24 occurs 16 feet of coal, with a low dip underlying sands and gravels and overlying sands.

Exposure No. **61.** Section in gulch in the NE. ¼ NW. ¼ SE. ¼ sec. 24. T. 11 S., R. 6 W.

	Ft.	in.
Sands.		
Coal	2	
Clay, pasty		5
Coal	3	7

Exposure No. **62.** Section in gulch in the NE. ¼ NW. ¼ SE. ¼ sec. 24. T. 11 S., R. 6 W.

	Ft.	in.
Coal		3
Clay	1	6
Coal		10
Clay		2
Coal (bony)	1	6
Coal	12	
Sand.		

Exposure No. **63.** In a gulch in the NW. ¼ NE. ¼ SE. ¼, 3 feet of coal (base concealed) is overlain by sand.

Combined section of exposures Nos. 59 to 63.

	Ft.	in.
Tough clay with three thin lignite beds	20	
Cross-bedded sands and gravel	150	
Coal	16	
Sand and gravel	40	
Coal	2	
Clay		5
Coal	3	6
Clay	1	6
Sand and gravel	35	
Coal		3
Clay	1	6
Coal		10
Clay	2	
Bony coal	1	6
Coal	12	
Sand	30	
Coal, partly concealed	3	

Exposure No. **64.** In a gulch in the NE. ¼ SE. ¼ SW. ¼ sec. 24, at an altitude of 2,520 feet, is 20 feet of coal, which strikes about east and dips north at a low angle.

Exposure No. **65.** Section in gulch in the SE. ¼ SE. ¼ SW. ¼ sec. 24. T. 11 S., R. 6 W. at at an altitude of 2,440 feet.

	Ft.	in.
Coal	10	
Clay		6
Coal	14	6

Exposure No. **66.** In a gulch in the southeast corner of the SW. ¼ sec. 24, at an altitude of 2, 370 feet, is a 15-foot coal bed that strikes N. 25° E. and dips 5° N.

Exposure No. **67.** Section at point of hill in the SW. ¼ SE. ¼ sec. 24. T. 11 S., R. 6 W.

	Feet.
Coal	20
Sands. etc	50
Coal	35
Sands etc	60
Coal (may extend a short distance into sec. 25)	15

Exposure No. **68.** Section in Hoseanna Creek in the SE. ¼ SW. ¼ SE. ¼ sec. 24, T. 11 S. R. 6 W.

	Feet.
Coal (same bed as exposure No. 59)	16
Sandy gravel and clay	50
Coal	15

Exposure No. **69.** On Hoseanna Creek near the center of the SE. ¼ sec. 24, is a 16-foot coal bed.

A little smut occurs near the head of the gulch in the NW. ¼ SE. ¼ NW. ¼.

Sec. 25.—The lowest (15-foot) bed at exposure No. 67 (see above) may cut over the line into the NW. ¼ NE. ¼ sec. 25.

Exposure No. **70.** Near the mouth of the gulch in the NW. ¼ NE. ¼ sec. 25. at an altitude of 2 250 feet. is a 4-foot bed of coal.

Exposure No. **71.** Section on Hoseanna Creek 500 feet below mouth of gulch containing exposure No. 70, in the NW. ¼ NE. ¼ sec. 25, T. 11 S., R. 6 W.

	Feet.
Coal	5
Clay	8
Coal	15

Strike N. 40° E., dip 20° N.

Exposure No. **72.** Section at mouth of gulch entering Hoseanna Creek from the east in the NE. ¼ SW. ¼ NE. ¼ sec. 25, at an altitude of 2,280 feet.

	Feet.
Coal	10
Sand, etc	30
Coal	20
Sands	40
Coal	4
Clay	6
Coal	20
Clay.	

The lowest bed of this exposure crosses the stream at an altitude of 2,340 feet.

Exposure No. **73.** A 5-foot bed of coal appears on a creek tributary to Hoseanna Creek from the east in the N. ½ SE. ¼ NE. ¼ sec. 25, at an altitude of 2,400 feet.

Exposure No. **74.** On a creek tributary to Hoseanna Creek from the east in the NE. ¼ SE. ¼ NE. ¼ sec. 25, at an altitude of 2,430 feet, is 18 feet of coal, partly burned.

Exposure No. **75.** At the head of the gulch in the NE. ¼ NE. ¼ SE. ¼ sec. 25, at an altitude of 2,580 feet, a 5-foot bed of coal is exposed.

Exposure No. **76.** Section on north bank of Hoseanna Creek one-fourth mile south of the northwest corner of the NE. ¼ sec. 25, T. 11 S., R. 6 W.

	Feet.
Coal	17(?)
Sand	60
Coal	4
Clay	⅙
Coal	5
Clay	10
Coal	28
Clay	8
Sand	20

A large amount of burned clay was seen on the side of a gulch in the SW. ¼ SE. ¼ NE. ¼ sec 25.

Exposure No. **77.** On the south bank of Hoseanna Creek near the forks, 800 feet north of the southeast corner of sec. 26, T. 11 S., R. 6 W., is at least 10 feet of coal (top and bottom concealed), striking N. 60° W. and dipping 30° SW. This bed was included in sample 26365 (p. 9).

On a stream entering Hoseanna Creek from the south in the SW. ¼ SW. ¼ sec. 25 is some coal which may be the bed in exposure No. 77. It has a dip of 15° W.

On the south side of Hoseanna Creek in the NW. ¼ SW. ¼ SW. ¼ sec. 25 is a coal bed which strikes N. 75° E. and dips 17° W.

Smut was seen near the center of the NE. ¼ SE. ¼, in the SE. ¼ SW. ¼ NE. ¼, in the E. ½ NE. ¼ SE. ¼, and in the NE. ¼. SE. ¼ NW. ¼.

Sec. 26.—The beds noted below were seen in sec. 26:

Exposure No. **78.** Section on west side of fault gulch in the NW. ¼ SE. ¼ sec. 26, T. 11 S., R. 6 W.

	Ft.	in.
Brownish sand	5	
Lignite with drab shale	2	6
Brownish sand	10	
Drab shale	2	
Cross-bedded sands and gravel	100	
Lignite (included in sample 26363, p. 9)	16	
Clay	3	
Cross-bedded sands and gravel	22	
Gravel	2–4	
Lignite	2	
Clay	10	
Cross-bedded sands and gravel	78	
Coal	2	6
Clay		3
Coal with bone in places	9	
Clay and bone		10
Coal (solid)	10	
Clay	3	
Cross-bedded sand and grits (estimated)	240	
Burnt coal bed (estimated)	15	
Clay		10–12
Cross-bedded sands and grits	50±	
Lignite (base concealed)	16–18	

Strike N. 80° W., dip 26° N.

Exposure No. **79.** Section east side of fault gulch on the north side of Hoseanna Creek, in the NW. ¼ SE. ¼ sec. 26, T. 11 S., R. 6 W.

	Feet.
Coal (six thin beds).	
Sands.	
Coal	4–5
Sandy clay	(?)
Coal	9–10
Concealed	(?)
Coal	5
Coal	1
Coal	2

Strike N. 85° E., dip 26° N.

Exposures of burned clay occur on the south side of Hoseanna Creek in the E. ½ SE. ¼ SW. ¼ sec. 26 and along the north side of the creek in the N. ½ SW. ¼ and the NW. ¼ SW. ¼ SE. ¼.

Exposure No. **80.** Section in gulch entering Hoseanna Creek from the north, one-fourth mile northeast of the southwest corner of sec. 26. T. 11 S., R. 6 W.

	Feet.
Coal (burned).	
Clay	50
Coal (part burned)	10±
Clay	25
Gray pebbly sand	35
Coal (included in sample 26364, p. 9)	12
Clay	25
Sand and gravel, iron stained at base	45
Coal	7
Clay	2
Coal	15
Clay	½
Coal	7
Concealed (probably carbonaceous shale)	5
Shaly coal	3
Sand and gravel with lignite sticks	30
Brown sandy clay	18
Coal	11½
Clay	½
Coal	10
Clay	½
Clay (?)	18
Coal	13
Clay	75+

Sec. 27.—In sec. 27 the following outcrops were seen:

Exposure No. **81.**—Section in cliffs on north fork of Hoseanna Creek in the NE. ¼ sec. 27, T. 11 S., R. 6 W.

	Feet.
Coarse gravel (Quaternary)	20
Unconformity (?).	
Sand and gravel	60
Coal	1
Clay	1
Coal	2
Clay	3
Coal	1
Clay with carbonaceous streaks	20
Clay	15
Gray sand and gravel	40
Coal	4
Clay	20
Brown sand and gravel	70
Fault (probably cuts out 110 feet of strata).	
Coal	23
White pebbly sand	60
Coal	11
Shale	2
Coal	4+

Exposure No. **82.** Section on stream just north of center of sec. 27, at an altitude of 1,910 feet.

	Feet.
Coal	10
Clay.	
Concealed	14
Coal	25

Strike N. 38° E., dip 15° N.

Exposure No. **83.** On a stream about 300 feet due south of the center of sec. 27 about 20 feet of coal is exposed.

Exposure No. **84.** On a stream about 500 feet due south of the center of sec. 27 occurs a bed of coal about 6 feet thick.

Exposure No. **85.** Section near southwest corner of sec. 27, T. 11 S., R. 6 W., on stream just east of section corner, at an altitude of about 1,825 feet.

	Feet.
Coal	8
Parting.	
Coal	30

Strike N. 30° E., dip 20° N.

Exposure No. **86.** In the western part of the SW. ¼ NW. ¼. sec. 27, in a stream at an altitude of 2,150 feet. is exposed a coal bed 15 feet thick.

Burned material and smut from what seems to be a large bed occurs in the northern part of the NW. ¼ SW. ¼, in the stream at an altitude of 1,950 feet.

Exposure No. **87.** In a cliff near the hilltop in the NW. ¼ SE. ¼ is 18 feet of coal.

Exposure No. **88.** In the west gulch in the NE. ¼ NW. ¼ sec. 27, at an altitude of 2,060 feet, occurs 9 feet of coal striking N. 60° E., and dipping 13° N.

Exposure No. **89.** Section on forks of stream in the NE. ¼ NW. ¼ sec. 27, T. 11 S., R. 6 W., at an altitude of 2,000 feet.

	Ft.	in.
Cross-bedded sand and gravel	15	
Coal	1	3
Sands and gravels	29	
Coal	4	6
Sandy clay	24	
Cross-bedded sand	80	
Coal	2	
Clay	5	

Strike N. 70° E., dip 15° N. (?).

Exposure No. **90.** A stream in the NW. ¼ SE. ¼ NW. ¼ sec. 27, at an altitude of 1,960 feet, shows 25 feet of faulted coal that strikes N. 78° E. and dips 20° N. This bed was included in sample 26366 (p. 9).

Exposure No. **91.** A stream in the E. ½ SE. ¼ NW. ¼ sec. 27, at an altitude of 1,945 feet, exposes 9 feet of coal.

Exposure No. **92.** Section on forks of north branch of Hoseanna Creek in the W. ½ SW. ¼ NE. ¼ sec. 27, at an altitude of 1,950 feet.

[Thickness estimated.]

	Feet.
Coal	6
Sands	30
Burnt bed	30 (?)
Sands	30
Coal	9 (?)

Two beds, apparently those of the upper part of exposure No. 92, crop out in the hill on the east side of the gulch in the NW. ¼ NW. ¼ NE. ¼ sec. 27.

Sec. 28.—The beds noted below occur in sec. 28:

Exposure No. **93.** Section on tributary of Hoseanna Creek in the northern part of the SE. ¼ NW. ¼ sec. 28, T. 11 S., R. 6 W.

	Ft.	in.
Coal	1	9
Clay	1	8
Coal	2	6
Clay	8	
Coal	2	10
Clay	5	
Carbonaceous clay		8
Sand and gravel	40	
Coarse gravel	2	
Carbonaceous clay	1	6
Coal	5	9

Strike N. 80° E., dip 15° N.

Exposure No. **94.** Near the mouth of the stream in the SE. ¼ SW. ¼ SE. ¼ sec. 28' on the west line of the section, at an altitude of 1,785 feet, is a coal bed more than 9 feet thick.

Exposure No. **95.** On a creek in the NW. ¼ SW. ¼ sec. 28 is a bed of coal of which 9 feet is exposed and the bed may be thicker. It strikes N. 30° E. and dips 8° N.

Exposure No. **96.** On a creek near the northwest corner of the NW. ¼ SW. ¼ sec. 28, at an altitude of 1,755 feet, about 20 feet of coal is exposed.

Exposure No. **97.** On the shoulder of the hill at the stream forks near the center of the SW. ¼ NW. ¼ sec. 28, at an altitude of 1,860 feet, is a bed of coal 2 feet 6 inches thick.

Exposure No. **98.** On the east branch of the stream just above the fork in the eastern part of the SW. ¼ NW. ¼ sec. 28, at an altitude of 1,785 feet, is 1 foot 7 inches of coal striking N. 58°–60° E. and dipping 7° N.

Coal smut was seen on Hoseanna Creek in the SW. ¼ SW. ¼ SE. ¼ and the SW. ¼ SE ¼. SW. ¼.

Burned clay apparently from a rather large bed, was found in much of the SE. ¼ SE. ¼, in the northern part of the SW. ¼ SE. ¼, in the S. ½ SE. ¼ SW. ¼, and in the NW. ¼ SW. ¼ SW. ¼.

Coal smut from what seemed to be a large bed was found in the southeast corner of the SE. ¼, and smut from what seemed to be a small bed in the stream at an altitude of 1,850 feet in the NW. ¼ SW: ¼.

Sec. 29.—Exposure No. **99.** A coal bed 18 feet thick is exposed on the north bank of Hoseanna Creek in the southern part of the SE. ¼ SE. ¼ sec. 29.

Exposure No. **100.** On a hillside in the eastern part of the SE. ¼ SW. ¼ sec. 29, at an altitude of 1,780 feet, is 6 feet of coal (bed C [1]).

Exposure No. **101.** A stream in the northeast corner of the SW. ¼ SW. ¼ sec. 29, at an altitude of 1,750 feet, shows 6 feet of coal (bed C [1]).

Exposure No. **102.** Section on creek in the southwest corner of the NE. ¼ SW. ¼ sec. 29, at an altitude of 1,765 feet.

	Ft.	in.
Coal (bed E [1])	20	
Parting		4
Coal	1	6
Clay.		

Exposure No. **103.** On a creek in the northern part of the NE. ¼ SW. ¼ sec. 29, at an altitude of 1,825 feet, is a bed of coal 2 feet 6 inches thick.

Burned clay, the result of the burning of a large bed, occurs in the SE. ¼ SE. ¼, in the NE. ¼ SE. ¼ SW. ¼. the SE. ¼ NE. ¼ SW. ¼. the southeast corner of the NW. ¼ SW. ¼, and the northern part of the SW. ¼ SW. ¼. Smut, probably from a small bed or beds, was seen on the stream in the NW. ¼ NW. ¼ NE. ¼ and the NW. ¼ SE. ¼ SW. ¼.

Exposure No. **104.** A creek near the center of the SE. ¼ NW. ¼ shows about 15 feet of coal.

Exposure No. **105.** Section on hillside on creek in the NE. ¼ SE. ¼ NW. ¼ sec. 29, T. 11 S., R. 6 W., at an altitude of 1,960 feet.

	Feet.
Coal (bed K)	3
Clay	2
Impure coal (bed J)	1

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[1] Letters indicate probable correlations with the coal beds of exposure No. 122 on p. 20.

Exposure No. **106.** A creek in the southeast corner of the NE. ¼ NW. ¼ sec. 29, at an altitude of 1,950 feet, exposes 4 feet of coal (bed L).

Exposure No. **107.** On the north bank of Hoseanna Creek in the SW. ¼ SW. ¼ sec. 29 is a bed of coal (bed B) 18 feet thick.

Sec. 30.—Exposure No. **108.** A tributary of Hoseanna Creek in the SE. ¼ NE. ¼ SE ¼ sec. 30, at an altitude of 1,735 feet shows a coal bed 20 feet thick.

Exposure No. **109.** A tributary of Hoseanna Creek in the SE. ¼ NW. ¼ SE. ¼ sec. 30, at an altitude of 1,785 feet, also exposes a 20-foot coal bed.

Exposure No. **110.** A coal bed about 18 feet thick is exposed on a tributary of Hoseanna Creek in the NE. ¼ NW. ¼ SE. ¼ sec. 30, at an altitude of 1,880 feet.

Exposure No. **111.** Section on north bank of Hoseanna Creek in the SE. ¼ SE. ¼ SW. ¼ sec. 30 (bed B), at an altitude of 1,650 feet.

	Ft.	in.
Coal[1]	7	
Clay		6
Coal[1]	12.	
Clay	1	
Coal[1]	7	

Exposure No. **112.** Section of bluff on north side of Hoseanna Creek in the SE. ¼ SW. ¼ SW. ¼ section 30, T. 11 S., R. 6 W., at an altitude of 1.650 feet.

	Feet.
Concealed	50
Coal (bed E)	20
Sand	15
Coal (bed D)	7
Sands and concealed	100
Coal (bed B) at stream level.	

Burned clay, apparently from the burning of a large coal bed. was seen in the SW. ¼ NE. ¼ SE. ¼, the NW. ¼ SW. ¼ SE. ¼, the SW. ¼ SE. ¼ SW. ¼, and the SE. ¼ SW. ¼ SW. ¼. Smut, probably from a large bed, occurs in the SW. ¼ NE. ¼ SE. ¼, in the SE. ¼ SE. ¼ NE. ¼, at an altitude of 1,810 feet; in the SW. ¼ SE. ¼ SE. ¼, and in the SE. ¼ SW. ¼ SE. ¼. Other smut was seen in the W. ½ SE. ¼ SW. ¼, and the E. ½ SW. ¼ SW. ¼.

Sec. 31.—The outcrop noted below occurs in sec. 31.

Exposure No. **113.** Section in gulch on the south side of Hoseanna Creek in the NE. ¼ SW. ¼ NE. ¼ sec. 31, T. 11S., R. 6 W.

	Feet.
Clay	60
Coal	2
Gray clay	2–3
Coal	4–5
Sands, etc.	

Sec. 33.—Much smut occurs along the stream in the SW. ¼ NW. ¼ and the NW. ¼ SW. ¼ sec. 31, also on the hill in the S. ½ SE. ¼. Burned beds were seen in the NE. ¼ SE. ¼ SE. ¼, the SE. ¼ NE. ¼ SE. ¼, the NW. ¼ SW. ¼ NE. ¼, and the SW. ¼ NE. ¼ SW. ¼.

Sec. 34.—Exposure No. **114.** On the south side of Sanderson Creek near the mouth, in the northern part of the SW. ¼ NE. ¼ sec. 34, was seen more than 4 feet of coal, strikeing east and dipping 25°–30° N.

Exposure No. **115.** On the north side of Sanderson Creek near the mouth, in the SE. ¼ NW. ¼ NE. ¼ sec. 34, is another bed of coal more than 4 feet thick. This bed seems to be about 50 feet above the bed of exposure No. 114.

Exposure No. **116.** On the north bank of Sanderson Creek in the SE. ¼ NE. ¼ NE. ¼ is a bed of coal 12 feet thick.

Coal smut is widely distributed in sec. 34. The smut in the northwest corner of the NW. ¼ is probably from a large bed. Burned coal beds and burned clay occur at many localities. The burned clay in the SE. ¼ NE. ¼ SE. ¼ is from a partly burned coal bed probably 20 feet thick.

Sec. 35.—Exposure No. **117.** On Sanderson Creek in the NW. ¼ SW. ¼ NW. ¼ a coal bed 15 feet thick crops out.

Exposure No. **118.** On Sanderson Creek in the NW. ¼ SW. ¼ NE. ¼ is about 15 feet of coal striking N. 70° W. and dipping 22° N.

Exposure No. **119.** On Sanderson Creek in the SE. ¼ SW. ¼ NE. ¼ burned shale overlies a bed of coal more than 20 feet thick.

Exposure No. **120.** On Sanderson Creek in the NE. ¼ NW. ¼ SE. ¼ is an exposure showing about 20 feet of coal striking N. 55° W. and dipping 12° N.

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[1] Included in sample 26362, p. 9.

Exposure No. **121.** On Sanderson Creek in the NE. ¼ SE. ¼ is over 8 feet of coal, which strikes N. 75° W. and dips 17° N. This may be the 20-foot bed of exposure No. 120.

Burned beds occur near the center of the NE. ¼ SE. ¼ and on the west line of the NW. ¼ SW. ¼. Coal smut was seen in the SW. ¼ NW. ¼.

Sec. 36.—Burned beds were seen in the SE. ¼ NE. ¼, the NW. ¼ NE. ¼, and the S. ½ SE. ¼ sec. 36.

MINING CONDITIONS.

In the south half of this township the coal is well exposed in the deep valleys of Hoseanna Creek and its tributaries, which have cut almost to the base of the nearly horizontal coal-bearing rocks. Consequently the coal of the south half of the township may be mined from hillside drifts. The mining units should be laid out with reference to the topography, each interstream area constituting a natural mining unit. The mine openings should be so situated as to secure natural drainage and down-grade haulage of the loaded mine cars.

The north half of the township, which is drained by Marguerite Creek, is not deeply dissected, and the amount of coal above drainage level in this half is small. For extensive mining in this part of the township shafts will probably be necessary.

TRANSPORTATION.

The coal of the south half of the township will find its outlet over a branch railroad extending up Hoseanna Creek from Nenana River. The western edge of the township is about 6 miles from Nenana River and a railroad can be built up Hoseanna Creek without serious difficulty.

The coal of the north half of the township can find a feasible outlet to the present or prospective markets only over a railroad down Marguerite, California, and Totatlanika creeks to Tanana River. There is no prospective need for such a road.

STATUS OF COAL LAND.

The coal of the north half of the township is so inaccessible that there will probably be no possibility of mining it for a long time. These lands have consequently not been subdivided into leasing blocks but will be held in their present status till there is a call for leases or for temporary mining permits.

The coal lands of the south half of the township have been subdivided into 16 leasing units (Nos. 10 to 25, inclusive), as indicated on the accompanying map and as described on pages 29-31.

T. 11 S., R. 7 W.

COAL EXPOSURES.

Sec. 25.—The coal-bearing rocks crop out throughout the southern part of sec. 25 but pass beneath the gravels that cover the northern part of the section. The following table probably records the complete sequence of all the coal beds that crop out in this section.

Exposure No. **122.** Section in gulch heading in the SE. ¼ SW. ¼ sec. 25, T. 11 S., R. 7 W.[1]

		Ft.	in.
Top of hill.			
Sands		60	
Impure coal and clay (bed O)		2	
Sands		23	
Coarse gravel over coal.			
Coal (bed N)		2	6
Clay		9	6
Coal	(bed M)	2	
Impure coal		3	
Sands (clay at top)		68	
Coal	(bed L)	4	6
Impure coal		1	
Cross-bedded sands and gravels		62	
Coal (bed K)		2	6
Clay		6	
Coal (bed J)		1	
Sands		43	
Coal (bed I)		1±	

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[1] The lower part (beds B to F, inclusive) is exposed in sec. 36.

		Ft.	in.
Concealed, mostly sand, with possibly two small coal beds		117	
Concealed, coal slump (bed H)		10?	
Sand and gravel, clay		55	
Coal (bed G)		7	3
Clay		10	
Sand		55	
Coal (bed F)		28	6
Sand		57	
Coal (bed E)		22	
Clay		4	
Sands and gravels		12	
Coal	(bed D)	3	6
Shaley coal		1	4
Coal		2	6
Clay		5	
Sands		16	
Clay and carbonaceous matter		4	
Clay		1	6
Sands with some gravel		15	
Coal	(bed C)	2	6
Clay		—	6
Coal		3	
Clay		15	
Sands		35	
Brown sand, locally indurated		1	
Coal	(bed B)	6	6
Clay		—	6
Impure coal		10	
Clay		2	
Coal		4	
Concealed, part coal		10	
Sands and gravel		110	

Exposures Nos. **123** to **130**. listed below, were seen on Popovitch Creek, the large creek in the eastern part of sec. 25. The letters "C" to "K" indicate probable correlations of the coal beds with those recorded in the section at exposure No. 122.

Exposure No. **123.** Popovitch Creek, SW. ¼ SE. ¼, altitude 1,670 feet. Coal (bed C?) about 4 feet thick; strike east, dip 14° N.

Exposure No. **124.** Popovitch Creek, SW. ¼ SE. ¼, altitude 1.680 feet. Coal (bed D?) more than 5 feet thick.

Exposure No. **125.** Popovitch Creek, SW. ¼ SE. ¼, altitude 1,705 feet. Thick coal bed, not measured (bed E).

Exposure No. **126.** Popovitch Creek, SE. ¼ SE. ¼, altitude 1,710 feet. Thick coal bed, not measured (bed F.)

Exposure No. **127**. Popovitch Creek, NE. ¼ SE. ¼. altitude 1,720 feet. Coal (bed G) more than 8 feet thick.

Exposure No. **128.** Popovitch Creek, NE. ¼ SE. ¼, altitude 1,755 feet. Woody coal (bed I) 1 foot 6 inches thick; strike N. 60° E., dip 10° N.

Exposure No. **129.** Section on Popovitch Creek in the NE. ¼ SE. ¼, sec. 25, T. 11 S., R. 7 W., at an altitude of 1,775 feet.

	Ft.	ins.
Coal (bed K)	2	
Clay	4	
Coal (bed J)	1	6

Exposure No. **130.** Popovitch Creek, SE. ¼ NE. ¼, altitude 1,800 feet. Coal (bed L) more than 3 feet thick.

Exposure No. **131.** Large creek in the NW. ¼ SW. ¼, altitude, 1,800 feet. Coal (small bed, I?) not measured.

Exposure No. **132.** Large creek in the NW. ¼ SW. ¼, altitude 1,805 feet. Coal (small beds, J and K?) not measured.

Sec. 26. The coal beds of sec. 26 are the western continuation of those exposed in sec. 25, but the lowest beds exposed in sec. 25 do not reach the surface in sec. 26.

Exposure No. **133.** Creek in the E. ½ SE. ¼ SE. ¼, altitude 1,660 feet. Coal (bed C or D) about 6 feet thick.

Exposure No. **134.** Creek in the E. ½ SE. ¼ SE. ¼, altitude 1,675 feet. Coal (bed E?), large bed; not measured.

Exposure No. **135.** Creek in E. ½ SE. ¼ SE. ¼, altitude 1,705 feet. Coal (bed F?), large bed; not measured.

Exposure No. **136.** Creek in E. ½ SE. ¼ SE. ¼, altitude 1,720 feet. Coal (bed G) more than 6 feet thick.

Exposure No. **137.** Creek in the E. ½ SE. ¼ SE. ¼, altitude 1,745 feet. Coal (bed H?) more than 18 feet thick; strike N. 65° E., dip 40° (?) N.

Exposure No. **138.** Creek in the E. ½ NE. ¼ SE. ¼, altitude 1,850 feet. Coal (bed L?) more than 4 feet thick.

Exposure No. **139.** Creek in the E. ½ NE. ¼ SE. ¼, altitude 1,870 feet. Coal (beds M and N) 6 feet thick.

Exposure No. **140.** Creek in the E. ½ NE. ¼ SE. ¼, altitude 1,890 feet. Coal (bed O) over 2 feet thick.

Exposure No. **141.** Creek in the W. ½ SE. ¼ SE. ¼, altitude 1,720 feet. Coal more than 6 feet thick.

Exposure No. **142.** Creek in the W. ½ SE. ¼ SE. ¼, altitude 1,820 feet. Coal more than 5 feet thick.

Exposure No. **143.** Creek in the W. ½ NE. ¼ SE. ¼, altitude 1,920 feet. Coal (bed L?) more than 4 feet thick.

Exposure No. **144.** Creek in the W. ½ NE. ¼ SE.¼, altitude 1,960 feet. Coal (beds M and N), not measured.

Exposure No. **145.** Creek in the SE. ¼ SW. ¼, altitude 1,775 feet. Coal 15 feet thick; strike N. 80° E., dip 10° N.

Exposure No. **146.** Creek in the SE. ¼, SW. ¼, altitude 1,800 feet. Coal, possibly slide, over 6 feet thick.

Exposure No. **147.** Creek in the SE. ¼ SW. ¼, altitude 1,805 feet. Coal 20 feet thick.

Exposure No. **148.** Creek in the SE. ¼ SW. ¼, altitude 1,870 feet. Coal over 18 inches thick.

Exposure No. **149.** Creek in the SE. ¼ SW. ¼, altitude 1,885 feet. Coal 6 feet thick; strike N. 70° E., dip 15° N.

Sec. 27.—The larger part of sec. 27 is gravel covered, and the only known coal exposures, which are in the SE. ¼ SE. ¼, seem to represent beds well up in the coal measures. It is possible that the entire section is underlain by coal.

Exposure No. **150.** Creek in the SE. ¼ SE. ¼, altitude 1,910 feet. Coal 6 feet thick; strike N. 85° E., dip 15° N.

Exposure No. **151.** Creek in the SE. ¼ SE. ¼, altitude 1,940 feet. Coal more than 18 feet thick.

Exposure No. **152.** Hillside by creek in the SE. ¼ SE. ¼, altitude 1,980 feet. Coal (probably same bed as No. 153) 2 feet thick; strike east, dip 20° N.

Exposure No. **153.** Creek in the SE. ¼ SE. ¼, altitude 2,000 feet. Coal 2 feet thick.

Coal float was seen in the creek in the SE. ¼, at an altitude of about 2,050 feet.

Sec. 28.—Sec. 28 is wholly covered with gravel, except probably a small area of coal measures in the SE. ¼ SE. ¼. No coal beds were seen, and it may be that any coal that the section contains is at a considerable depth.

Sec. 30.—Sec. 30 is covered with gravel, except probably a small area of coal measures in the southern part of the SW. ¼. The depth to the coal and even the presence of coal in this section are uncertain, but coal beds are exposed in the bank of Nenana River, on the unsurveyed land west of sec. 30, that should pass under this section unless they are cut out by the unconformity at the base of the gravels.

Sec. 31.—No coal beds are known to crop out in sec. 31, but there are coal beds exposed both south and west of this section that should pass beneath it unless they are cut out by the unconformity at the base of the gravels.

Sec. 32.—The larger part of sec. 32 is covered with gravels, and no coal outcrops are known. Some of the coal beds exposed in sec. 33 of this township and in sec. 5, T. 12 S., R. 7 W., should underlie part of sec. 32 unless they are cut out by the unconformity at the base of the gravels.

Sec. 33.—The exposures noted below were recorded in sec. 33.

Exposure No. **154.** Section in cliff on west side of stream in the W. ½ SW. ¼ sec. 33, T. 11 S., R. 7 W.

	Feet.
Sands and gravels	50±
Coal	3
Sands and gravels	40
Coal	3
Sands, gravels and concealed	30
Coal (a few inches).	
Sands	25
Coal	3
Clay	6
Coal	3
Sands, clays, concealed	100±

The beds recorded above are nearly horizontal but seem to dip slightly to the south.

Exposure No. **155.** On the creek in the SE. ¼ NW. ¼, at an altitude of 1,920 feet, is a coal bed about 3 feet thick.

Exposure No. **156.** A creek in the SE. ¼ SE. ¼, at an altitude of 1,575 feet exposes a coal bed about 6 feet thick that seems to be horizontal.

Coal smut, apparently derived from a small bed, was seen at an altitude of 1,750 feet in the bank of the creek in the NW. ¼ SW. ¼.

Sec. 34.—The southern part of the S. ½ SE. ¼ and the southern part of the SE. ¼ SW. ¼ sec. 34 have a surface of schist and are consequently barren of coal. The coal-bearing rocks overlie the schist and form the surface of the rest of the section, except in several areas of gravel that may be assumed to be underlain by the coal measures. The exposures in the coal measures are not good, and coal beds have been seen only at the localities described below.

Exposure No. **157.** Creek in NE. ¼, altitude 1,760 feet. Coal about 15 feet thick.

Exposure No. **158.** Creek in the NE. ¼, altitude 1,845 feet. Coal about 25 feet thick.

Exposure No. **159.** Creek in the NE. ¼, altitude 1,875 feet. This exposure consists of a few feet of coal overlain by much burned material. It apparently represents a large bed.

Exposure No. **160.** Bluff on west side of creek in the NE. ¼, altitude 1,800 feet. This exposure consists of a burned bed about 30 feet thick, probably the same bed as No. 159.

There is also a burned bed near the base of the coal measures on the hill in the S. ½ SE. ¼.

Sec. 35.—The following outcrops were seen in sec. 35:

Exposure No. **161.** Section of bluff on north side of creek in the NW. ¼ NW. ¼ sec. 35, T. 11 S., R. 7 W.

	Ft.	in.
Coal	25	
Sands, etc	35	
Coal	6	
Sand	55	
Coal[1]	12	
Clay		6
Coal[1]	5	
Clay		6
Coal[1]	15	
Sand	50	
Coal	8	
Sands, etc	30	
Coal (impure)	2	
Sand and clay	10	
Coal (impure)	2	

Exposure No. **162.** Creek in the NE. ¼ NW. ¼, altitude 1,720 feet. Coal 20 feet thick; strike east, dip 23° N.

Exposure No. **163.** Section of bluff on north side of Hoseanna Creek near center of the NE. ¼ sec. 35, T. 11 S., R. 7 W.

	Feet.
Coal	6±
Sand and gravel	50±
Coal (bed B)	30±

Exposure No. **164.** Small creek in the NW. ¼ NE. ¼. Coal (bed B ?), not measured.

Exposure No. **165.** Creek in the NE. ¼ NE. ¼. Coal (bed B ?), not measured.

Exposure No. **166.** North bank of Hoseanna Creek in the SE. ¼ NE. ¼. Coal (bed A ?), 20 feet thick. This is believed to be the lowest coal bed of this district. It is probably 100 feet or more below bed B of exposure No. 122.

Exposure No. **167.** North bank of Hoseanna Creek in the SW. ¼ NE. ¼. Coal (bed A ?), about 20 feet thick.

There is an outlier of coal-bearing rocks south of Hoseanna Creek in the S. ½ sec. 35 that consists chiefly of burned clay and clinker, probably derived from the burning of bed A and possibly of bed B. There is probably little if any unburned coal in this area.

Sec. 36.—Sec. 36 contains the beds noted below.

Exposure No. **168.** Creek in the NW. ¼ NW. ¼. Coal (bed B ?), large bed, not measured.

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[1] Included in sample 26369, p. 9.

The lower part of exposure No. 122 (see p. 20) as recorded below is exposed in sec. 36.

Section of bluff on north bank of Hoseanna Creek in the N. ½ NW. ¼ sec. 36, T. 11 S., R. 7 W.

		Ft.	in.
Coal (bed F)		28	6
Sand		57	
Coal (bed E)		22	
Clay		4	
Sands and gravels		12	
Coal	(bed D)	3	6
Shaly coal		1	4
Coal		2	6
Clay		5	
Sands		16	
Clay and carbon matter		4	
Clay		1	6
Sands, with some gravel		15	
Coal	bed C)	2	6
Clay			6
Coal		3	
Clay		15	
Sands		35	
Brown sand (locally indurated)		1	
Coal	(bed B)	6	6
Clay			6
Impure coal		10	
Clay		2	
Coal		4	
Concealed (part coal)		10	
Sands and gravel		110	

Altitude, 1,580 feet; stream level.

MINING CONDITIONS.

The exposed coal of T. 11 S., R. 7 W., is restricted to the southern quarter of the township, where it crops out in a belt situated on the north side of Hoseanna Creek and lying between the schists south of and in the creek valley and the gravels in the high hills north of the creek. The coal-bearing rocks unconformably overlie the schists and unconformably underlie the gravels. They strike about east and dip in general about 15° N.

There is no available evidence concerning the distance to which the coal extends beneath the gravels, except that on the northern margin of this gravel area, in T. 10 S., R. 7 W., the schists and not the coal-bearing rocks emerge from beneath the gravels.

Neither is there any evidence concerning the depth to the coal in those areas where it may be present under the gravels. The northward dip of 15° if continued would carry the coal down at a rate of about 1,400 feet to the mile beneath the gravels, which are at least 2,000 feet thick. The amount of dip may increase or may diminish beneath the gravels, and the direction of the dip may hold northward or may be reversed. On the eastern edge of the gravel area in T. 11 S., R. 6 W., and T. 10 S., R. 6 W., reversals of dip and other structural irregularities were observed.

It is consequently unsafe to assume that the area of minable coal includes anything more than the area of actual coal outcrops, with a narrow additional zone along the southern margin of the gravels. For purposes of land classification it was assumed that only those gravel-covered areas lying within half a mile of outcrops of coal-bearing rocks are probable coal land. Cautious investors may well regard even this assumption as underconservative.

The coal beds are well exposed in the deep gulches of most of the creeks flowing southward into Hoseanna Creek. The most favorable sites for immediate mining are localities where the larger coal beds cross these creeks, and the natural mining units are the interstream areas.

A large amount of coal can be won by drift mining from openings on the northern tributaries of Hoseanna Creek. It is likely that a considerable amount of coal, possibly a large proportion of that for which there will be a demand in the immediate future, can be mined by stripping. A favorable site for stripping is on the 20 foot bed (A) in the north bank of Hoseanna Creek in the S. ½ NE. ¼ and the N. ½ SE. ¼ sec. 35. The thickness of the coal, its position on the edge of the creek, and the comparatively large area with thin overburden are the favorable features for open mining at this locality.

TRANSPORTATION.

All the known coal in T. 11 S., R. 7 W., is on Hoseanna Creek or its tributaries and will be easily accessible from a branch railroad extending up the creek. The part of this proposed branch within this township will all be within 6 miles of the main railroad line on Nenana River.

STATUS OF COAL LAND.

The coal lands of the north half of T. 11 S., R. 7 W., in the gravel-covered area in secs. 12 and 13, are not definitely known to contain workable coal and are so situated as to be practically inaccessible by any proposed means of transportation. They have consequently not been subdivided into leasing units or offered for lease but will be held in their present status.

The coal lands of the south half of T. 11 S., R. 7 W., are the most accessible of the surveyed coal lands of the Nenana field. They have been subdivided into seven leasing units (Nos. 1, 2, 4, 5, 7, 8, and 9), as indicated on the accompanying map, and as described on pp. 27–29.

T. 12 S., R. 7 W.

COAL EXPOSURE.

Sec. 2.—No outcrops of coal beds were seen in sec. 2, but there are burned beds in the S. E. ¼ S. W. ¼.

Sec. 3.—Exposure No. **169.** South bank of Hoseanna Creek at mouth of tributary in the N. W. ¼ N. E. ¼ sec. 3. Coal (poorly exposed) about 5 feet thick.

Coal smut was seen in the S. E. ¼ S. E. ¼ and at several localities in the N. W. ¼.

Sec. 4.—Coal smut, probably derived from a fairly large bed, was seen at the base of the hill on the south side of Hoseanna Creek in the S. W. ¼ N. W. ¼ sec. 4. Smut was seen also at two localities in the N. E. ¼ S. W. ¼.

Sec. 5.—The following exposures were recorded in sec. 5:

Exposure No. **170.** South bank of Hoseanna Creek in the S. E. ¼ N. E. ¼. Coal more than 6 feet thick; strike N. 35° W., dip 10° S.

Exposure No. **171.** South bank of Hoseanna Creek in the N. W. ¼ N. E. ¼. Coal (large bed), not measured.

Exposure No. **172.** South bank of Hoseanna Creek near west line of N. W. ¼ N. E. ¼. Coal 15 feet thick.

Exposure No. **173.** Section on north bank of Hoseanna Creek about 1 mile above the mouth, in the N. E. ¼ N. W. ¼ sec. 5, T. 12 S., R. 7 W.

	Feet.
Coal	8±
Coal (included in sample 26367, p. 9)	7

Strike N. 105° E., dip 12° S.

Exposure No. **174.** South bank of Hoseanna Creek in the NE. ¼ NW. ¼, about 600 feet downstream from No. 173 and an undetermined distance stratigraphically above it. Coal about 10 feet thick.

Exposure No. **175.** North bank of Hoseanna Creek near west line of the SW. ¼ NW. ¼, coal 3 feet thick.

MINING CONDITIONS.

Coal is exposed along the lower course of Hoseanna Creek in beds that dip gently southward. These beds should be minable from openings situated on the creek. The amount of minable coal south of the creek is problematic, for the beds dip southward and within a short distance pass beneath gravels. A fault that extends westward near the southern line of secs. 1, 2, and 3 may cut out the coal in portions of secs. 4 and 5. The extensive slumping on the hillsides in secs. 3 and 4 makes it difficult to determine the attitude of the coal-bearing rocks.

TRANSPORTATION.

The coal of T. 12 S., R. 7 W., is comparatively easy of access. The main line of the Government railroad will extend, according to present surveys, along the west bank of Nenana River in sec. 6. The coal beds exposed on Hoseanna Creek in the N. W. ¼ sec. 5 are within a mile of the surveyed line of the main railroad and are directly on the line of the proposed Hoseanna Creek branch.

STATUS OF COAL LAND.

The coal lands of T. 12 S., R. 7 W., have been divided into four leasing units (Nos. 2, 3, 4, and 6), as indicated on the accompanying map and as described on pp. 27-29. Two of these (Nos. 3 and 6) lie wholly within this township, and Nos. 2 and 4 lie chiefly in T. 11 S., R. 7 W.

UNSURVEYED LANDS NEAR MAIN LINE OF RAILROAD.

There is known to be coal in the unsurveyed lands along Nenana River on the main line of the railroad.

On the north bank of Hoseanna Creek, a little less than half a mile above its mouth, are two coal beds each about 3 feet thick. The eastern (lower) of these beds is near the west line of sec. 5, T. 12 S., R. 7 W., and is described above (exposure No. 175). The western (upper) bed (exposure No. 176) is in the unsurveyed lands that should be sec. 6, T. 12 S., R. 7 W.

On the east bank of Nenana River about a quarter of a mile below Hoseanna Creek the following exposure was seen in a bluff cut on the side of a gravel-covered bench 30 feet above the river.

Exposure No. **177.** Section on east bank of Nenana River one-fourth mile below Hoseanna Creek.

	Feet.
Gravel (horizontal)	10
Sand and gravel	2
Coal	$2\frac{1}{2}$
Carbonaceous shale	1

Strike N. 30° E., dip 10° NW.

Two higher coal beds are exposed in the river bank farther downstream. Exposure No. **178** is 500 feet below No. 177 and shows a coal bed 2 feet thick. Exposure No. **179** is 800 feet below No. 177 and shows a coal bed 5 feet thick. The three coal beds last described are all situated in the unsurveyed lands that should be sec. 6, T. 12 S., R. 7 W.

Exposure No. **180** is on the east bank of Nenana River, about 2 or $2\frac{1}{2}$ miles below Hoseanna Creek, in a bluff about 300 feet high, containing eight or more coal beds. The three lowest beds were measured and found to be $4\frac{1}{2}$, 15, and 10 feet thick. The rocks of this exposure form an anticline having northward dips of 10° to 20° on the north flank and southward dips of 30° to 65° on the south flank. These steep dips continue only a few hundred feet beyond which the beds become nearly horizontal. This exposure is situated on unsurveyed lands that should be sec. 25, T. 11 S., R. 8 W.

One of the beds of the above-described exposure was observed at water level on the west bank of Nenana River. (See Exposure No. 185.)

The amount of accessible coal west of Nenana River is problematic. The known exposures are all in the river bank on the edge of a gravel-covered terrace. The higher lands that lie farther back from the river have not been examined closely but seem to be largely covered with gravels.

The exposed coal beds seen on the west side of Nenana River are described in detail below.

Exposure No. **181.** North end of bluff on west bank of Nenana River opposite mouth of Healy Creek. Coal 2 feet 6 inches thick; strike N. 87° E., dip 48° N. This exposure continues southward into cliffs about 80 feet high, which are inaccessible from the west bank of the river. These cliffs as viewed from Healy Creek in 1916 contained eight to ten coal beds, all dipping about 45° N. Several of these beds are of fair size; some of them possibly being 10 feet or more thick, but nothing is known as to what partings and impurities they may contain. The top of the cliff is formed of gravels that lie horizontally upon the coal beds and extend back into flat terraces beneath which the coal-bearing rocks are concealed. There probably is little if any minable coal above river level at this locality.

Exposure No. **182.** West bank of Nenana River at rapids $1\frac{1}{4}$ miles below Hoseanna Creek. Coal more than 4 feet thick; strike N. 85° E., dip 70° S. This coal bed crosses the river in a reef that causes the rapids, in which the river makes an abrupt drop of several feet. The abruptness of this fall indicates that the coal bed may be considerably thicker than the part actually exposed. The coal bed passes under a gravel terrace about 8 feet high.

Exposure No. **183.** West bank of Nenana River about $1\frac{3}{4}$ miles below Hoseanna Creek. Clean, blocky lignite over 6 feet thick; strike N. 75° W., dip 8° N. The base of this exposure is at water level. The top is cut off by the gravels that form a bench 12 or 15 feet high. It is possibly the same bed as that at exposure No. 184.

Exposure No. **184.** West bank of Nenana River at rapids about 2 miles below Hoseanna Creek. Coal more than 5 feet thick; strike N. 2° W., dip 18° W. The base of this exposure is at water level. The coal is overlain and beveled by gravels that form a bench about 15 feet high.

Exposure No. **185.** West bank of Nenana River $2\frac{1}{2}$ miles below Hoseanna Creek. Coal over 3 feet thick; strike N. 60° W., dip 25° SW. This exposure is at the edge of the water, at the base of a 9-foot gravel bank. It is believed to represent part of a coal bed which, as exposed on the opposite bank of the river, is 10 or 15 feet thick.

Exposure No. **186.** Head of little lake about $2\frac{1}{2}$ miles northwest of mouth of Hoseanna Creek, about 120 feet east of station R17486, Hayden's line. Coal over 3 feet thick; strike N. 68° E., dip 20° NW. This coal bed is partly exposed, both roof and floor being concealed, near the base of a gravel bench. About 8 feet of bench gravel overlies the coal. This bench is about 200 feet wide and is succeeded by a higher bench, about 30 feet high, in the face of which no exposures except gravel were noted.

LEASING BLOCKS.

The leasing blocks described below lie in the valley of Hoseanna Creek. The coal exposures referred to are described above by townships and sections. The numbers of the exposures correspond with those on the map.

Areas of leasing blocks in the Nenana coal field.

	Acres.		Acres.
Block 1	about 1,944.00	Block 14	1,280.00
2	840.00	15	560.00
3	720.00	16	1,080.00
4	1,120.00	17	480.00
5	1,360.00	18	400.00
6	760.00	19	720.00
7	1,240.00	20	560.00
8	160.00	21	680.00
9	1,040.00	22	680.00
10	1,177.55	23	388.32
11	393.33	24	589.08
12	1,280.00	25	790.05
13	600.00		

Blocks 2 and 3, containing 840 and 720 acres, respectively, have been reserved for Government use.

Block 1 contains sec. 30 (except the NE. ¼ and the NE. ¼ NW. ¼) and sec. 31, T. 11 S., R. 7 W. (area, 1,054.16 acres), and also an unsurveyed lot described as follows: Beginning at the northwest corner of sec. 30, T. 11 S., R. 7 W., thence due west to the right of way of the main line of the Government railroad, thence southward along said right of way to the west line (extended) of sec. 31, T. 11 S., R. 7 W., thence north along the west line of secs. 31 and 30, T. 11 S., R. 7 W., to the place of beginning, containing 890 acres, more or less. The total area of block 1 is thus about 1,944 acres. This block is mostly covered with gravel, and the only coal beds seen in it were at exposure No. 180, on the bank of Nenana River, on the unsurveyed land west of sec. 30. The quantity, the depth, and even the presence of coal in part of this block may be somewhat uncertain, but it is believed that the coal beds shown in exposure No. 180 pass under the block unless they are cut out by the unconformity at the base of the gravels.

Block 2 contains the SE. ¼ SE. ¼ sec. 29 and all of sec. 32, T. 11 S., R. 7 W. and the N. ½ NE. ¼ and N. ½ NW. ¼ sec. 5, T. 12 S., R. 7 W. The total area is 840 acres. Exposures Nos. 171, 172, 173, and 174 are in this block, and sample 26367 was obtained here. The exposed coal beds of this block are minable from openings on Hoseanna Creek. There may be other coal beds minable from openings on the hillsides or from shafts. Possibly some of the coal near Hoseanna Creek can be mined by stripping. This block has been reserved for Government use.

Block 3 contains the SW. ¼ and S. ½ NW. ¼ sec. 4 and the S. ½, S. ½ NE. ¼, and S. ½ NW. ¼ sec. 5, T. 12 S., R. 7 W. The total area is 720 acres. Exposures Nos. 170 and 175 are in this block. The coal beds exposed on Hoseanna Creek dip gently southward and should be minable in slopes from openings situated near the creek. The amount of minable coal south of the creek is problematic as the beds dip southward and within a short distance pass beneath gravels. A fault that extends west near the south line of secs. 1, 2, and 3, T. 12 S., R. 7 W., may cut out the coal in portions of this block. There is possibly some coal in this block that can be mined by stripping. This block has been reserved for Government use.

Block 4 contains the S. ½ and S. ½ NE. ¼ sec. 28 and all of sec. 33, T. 11 S., R. 7 W., and the N. ½ NW. ¼ sec. 4, T. 12 S., R. 7 W. The total area is 1,120 acres. Exposures Nos. 154, 155, and 156 are in this block. The small coal beds that are known to crop out in this block may be mined from hillside openings in the valley of the small creek in the W. ½ sec. 33. It is probable that the block contains larger beds that can be reached by a shaft on Hoseanna Creek.

Block 5 contains the S. ½ SE. ¼ and SE. ¼ SW. ¼ sec. 22, all of sec. 27, except the NW. ¼ NW. ¼, and all of sec. 34, T. 11 S., R. 7 W. The total area is 1,360 acres. Exposures Nos. 150, 151, 152, 153, 157, 158, and 159 are in this block. The coal beds exposed in this block dip about 10° or 15° N. and are minable in drifts or slopes from openings on the tributary of Hoseanna Creek that flows through the eastern part of the block. A special mine spur must be built up this creek in order to reach the mine sites.

Block 6 contains the SW. ¼ SW. ¼ sec. 2, the S. ½ SE. ¼ and W. ½ sec. 3, and the E. ½ sec. 4, T. 12 S., R. 7 W. The total area is 760 acres. No coal exposures were seen in this block. Smut was seen at several localities, and a coal bed (exposure No. 169) was seen just outside the block, in the NW. ¼ NE. ¼ sec. 3. The extensive slumping on the hillsides in secs. 3 and 4 makes it difficult to determine the position and attitude of the coal beds.

Block 7 contains the S. ½ sec. 23, all of sec. 26, and the N. ½ NE. ¼ NW. ¼, and NW. ¼ SW. ¼ sec. 35, T. 11 S., R. 7 W. The total area is 1,240 acres. Exposures Nos. 133 to 149 and 161 to 165, inclusive, are in this block, and sample 26369 was obtained here. The coal beds exposed in this block are minable in drifts or slopes from openings on the small creeks in secs. 26 and 35. These beds have an average dip of 10° or 15° N. Mine spurs, half a mile to 1 mile long, must be built up these tributaries to reach the mine sites.

Block 8 contains the S. ½ NE. ¼ and N. ¼ SE. ¼ sec. 35, T. 11 S., R. 7 W., and has an area of 160 acres. Exposures Nos. 166 and 167 are in this block. Both these exposures are on a 20-foot bed that is believed to be the lowest coal bed of this district. This bed crops out on the north bank of Hoseanna Creek and lies nearly flat. It has a comparatively thin overburden and is believed to contain several hundred thousand tons of coal that can be mined by stripping.

Block 9 contains the SE. ¼ and S. ½ SW. ¼ sec. 24, all of sec. 25, and the N. ½ NE. ¼ and N. ½ NW. ¼ sec. 36, T. 11 S., R. 7 W. The total area is 1,040 acres. Exposures Nos. 122 to 132, inclusive, and 168 are in this block. The coal beds exposed in this block dip northward at angles that probably average between 10° and 15°. They are minable in drifts or slopes from openings on the tributaries of Hoseanna Creek. Short spurs must be extended up these creeks to reach the mine sites.

Block 10 contains all of sec. 19 except the W. ½ NW. ¼ and all of sec. 30, T. 11 S., R. 6 W., and has an area of 1,177.55 acres. Exposures Nos. 108 to 112, inclusive, are in this block, and sample 26362 was obtained here. The coal beds exposed in this block are minable in drifts or slopes from openings on the north bank of Hoseanna Creek or on the two small tributaries in the E. ½ sec. 30.

Block 11 contains the N. ½ and NE. ¼ SW. ¼ sec. 31, T. 11 S., R. 6 W., and the SE. ¼ NE. ¼ sec. 36, T. 11 S., R. 7 W., and has an area of 393.33 acres. Exposure No. 113 is in this block. One or more of the thick coal beds (beds A, B ?, and C ?) in the lower part of the coal measures crop out in this block. The coal beds dip north at approximately the general slope of the south side of the valley of Hoseanna Creek. The block probably contains areas of coal that can be mined by stripping, but in attempting to do this care must be taken not to remove the present support of the surface, or there will be dangerous slides on the dip slopes that form the valley wall. If the coal is taken out from above this danger can probably be obviated. Extensive sliding has already occurred on the dip slopes, and for this reason the coal beds were not mapped and measured.

Block 12 contains all of secs. 20 and 29, T. 11 S., R. 6 W., and has an area of 1, 280 acres. Exposures Nos. 53 and 99 to 107, inclusive, are in this block. The coal-bearing rocks of this block lie in a gently folded syncline in which the lower coal beds reach the surface in the northern part of sec. 20 and the southern part of sec. 29. The coal beds exposed in sec. 29 can be mined in drifts or slopes from openings on the north bank of Hoseanna Creek and on its tributaries. The lower coals of sec. 20 and part of the coal of sec. 30 could probably be mined from a shaft on the creek in the NE. ¼ sec. 30.

Block 13 contains all (except the SE. ¼ SE. ¼) of sec. 32, T. 11 S., R. 6 W., and has an area of 600 acres. No exposures were measured in this block, sliding on the dip slopes having so disturbed the outcrops that measurements would not be reliable. Several of the thick coal beds in the lower part of the coal measures are known to cover considerable areas in this block. These beds may be minable in drifts or by stripping, but in working by either method the danger of extensive slides on the dip slopes must be carefully considered.

Block 14 contains all of secs. 21 and 28, T. 11 S., R. 6 W., and has an area of 1,280 acres. Exposures Nos. 93 to 98, inclusive, are in this block. The recorded dips in sec. 28 are 7°–15° N. In sec. 21 no exposures or dips were recorded, but the beds should dip south, as in the northern part of block 12. The coal beds should be minable in drifts or slopes from openings on Hoseanna Creek and on the tributary in the western part of the block. The deeper coals should be mined from a shaft on the axis of the syncline near the northwest corner of sec. 28 or, preferably, from the same shaft as the deeper coals in block 12.

Block 15 contains all (except the E. ½ NE. ¼) of sec. 33, T. 11 S., R. 6 W., and has an area of 560 acres. No exposures were measured in this block, but many coal smuts and burned outcrops were noted. The coal beds dip north at approximately the general slope of the valley wall and may be minable in drifts from openings on Hoseanna Creek or its tributaries. There may be some small areas that can be stripped. In using any method of mining the danger of causing extensive slides on the dip slopes must be carefully considered.

Block 16 contains all of sec. 22 and all (except the SE. ¼ and SE. ¼ SW. ¼) of sec. 27, T. 11 S., R. 6 W., and has an area of 1,080 acres. Exposures Nos. 54 to 57, 81 to 86, and 88 to 92, inclusive, are in this block, and sample 26366 was obtained here. The coal beds that crop out in the S. ½ sec. 22 and in sec. 27 dip 5°–20° N. and are minable in drifts and slopes from openings on the tributary of Hoseanna Creek. A mine spur 1½ miles long will be required to reach these mine sites from the proposed railroad on Hoseanna Creek. The coal beds that crop out on Marguerite Creek, in the northern part of sec. 22, dip about 30° S. It is probable that the coal in the northern part of the block can be reached through the workings in the southern part.

Block 17 contains the SE. ¼ and SE. ¼ SW. ¼ sec. 27, the E. ½ NE. ¼ sec. 33, and the NW. ¼ and NW. ¼ NE. ¼ sec. 34, T. 11 S., R. 6 W. The total area is 480 acres. Exposures Nos. 87 and 115 are in this block. The coal beds of this block can probably be mined in drifts from hillside openings on Hoseanna Creek and on the tributary draining sec. 27.

Block 18 contains the S. ½ NE. ¼ and S. ½ sec. 34, T. 11 S., R. 6 W., and has an area of 400 acres. Exposure No. 114 is in this block. The coal beds of this block dip north and can be in part mined from hillside drifts. The lower coal can best be reached by a shaft on Hoseanna Creek.

Block 19 contains all of sec. 23 and the N. ½ NW. ¼ sec. 26, T. 11 S., R. 6 W., and has an area of 720 acres. Exposure No. 58 is in this block. Most of the coal beds shown in exposure No. 81, block 16, crop out in the southwestern part of block 19. The coal of this block can probably be most easily mined from openings on the creek in the NE. ¼ sec. 27, in block 16.

Block 20 contains all (except the N. ½ NW. ¼) of sec. 26, T. 11 S., R. 6 W., and has an area of 560 acres. Exposures Nos. 78, 79, and 80 are in this block, and samples 26363 and 26364 were obtained here. The coal beds exposed in this block dip about 26° N. They are minable in slopes from hillside openings on the north side of Hoseanna Creek.

Block 21 contains the NE. ¼ NE. ¼ sec. 34, and all of sec. 35, T. 11 S., R. 6 W., and has an area of 680 acres. Exposures Nos. 116 to 121, inclusive, are in this block. These coal beds dip north at observed angles of 12° to 22°. They are minable in drifts and slopes from openings on Sanderson Creek. The lower coal beds are below the surface on Sanderson Creek and must be reached by a shaft, which should preferably be situated on Hoseanna Creek in block 17 or 20.

Block 22 contains the W. ½, W. ½ NE. ¼, and W. ½ SE. ¼ sec. 24, and the NW. ¼ and NW. ¼ SW. ¼ sec. 25, T. 11 S., R. 6 W. The total area is 680 acres. Exposures Nos. 59 to 69, inclusive, and 76 are in this block. These coal beds lie nearly flat, the observed dips ranging from 5° N. to 5° S. They can be mined from drift openings on the bank of Hoseanna Creek and on the hillsides above.

Block 23 contains the E. ½ SE. ¼ sec. 24, and the N. ½ NE. ¼ sec. 25, T. 11 S., R. 6 W., and the SW. ¼ sec. 19, and the N. ½ NW. ¼ sec. 30, T. 11 S., R. 5 W. The total area is 388.32 acres. Exposures Nos. 7, 16, 17, 63, 69, 70, 71, and 76 are in this block. These coal beds are nearly horizontal and may be mined from hillside openings in the banks of Hoseanna Creek.

Block 24 contains the S. ½ NE. ¼, SE. ¼, E. ½ SW. ¼, and SW. ¼ SW. ¼ sec. 25, T. 11 S., R. 6 W., and the S. ½ NW. ¼ and SW. ¼ sec. 30, T. 11 S., R. 5 W. The total area is 589.08 acres. Exposures Nos. 72, 73, 74, 75, and 77 are in this block, and sample 26365, was obtained here. The coal beds that crop out in this block can be mined in drifts and slopes from hillside openings.

Block 25 contains the N. ½, N. ½ SE. ¼, and N. ½ SW. ¼ sec. 36, T. 11 S., R. 6 W., and the NW. ¼, N. ½ SW. ¼, NW. ¼ SE. ¼, and SW. ¼ NE. ¼ sec. 31, T. 11 S., R. 5 W. Its area is 790.05 acres. No coal exposures were recorded in this block, outcrops being poor. The coal beds that doubtless crop out in this block probably dip north and should be minable from openings on the creek in the N. ½ sec. 36 or through workings in block 24.

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